

ENERGY NEEDS CHOICES AND POSSIBILITIES – SCENARIOS TO 2050

by Doug McKay, Senior Energy Analyst, Global Business Environment, Shell International, United Kingdom

To assist Shell's thinking about its: technology portfolio; new business portfolio; public policy positions around issues like climate change and sustainable development, energy scenarios to 2050 have been developed

Two scenarios, *Dynamics as Usual* and *The Spirit of the Coming Age*, consider different energy futures depending on the development, impact, and timing of a number of forces. We appear to be entering a particularly innovative period, with a wide set of possibilities for energy development, and more than one path to a sustainable energy system.

The overarching question for these scenarios is 'what energy needs, choices and possibilities will shape a global energy system which halts the rise in human-induced carbon dioxide emissions within the next 50 years - leading to a stabilising of atmospheric carbon levels below 550 ppmv – without jeopardising economic development?'

Dynamics as Usual highlights the key drivers of resource scarcity, environment and security concerns, competitive responses by incumbent technologies and competing societal priorities. Looking back from 2050, the energy transition looks to be a continuation of past dynamics – a gradual shift from high to low carbon fuels driven by societal demands for cleaner, more convenient energy. It shows a relatively direct path towards a range of new renewables, supported by strong gas growth in the medium term, but only after advances in energy storage and development of a next generation of renewables around 2025. By 2050, renewables could account for a third of world primary energy and be supplying all incremental energy. But underlying this transition is a process of intense competition, maturing of new technologies and shifting of social priorities, which makes the transition anything but smooth – dynamics as usual.

In *The Spirit of the Coming Age*, the impact of a major technology discontinuity is highlighted. The driver is superior end-use technology pulled by consumers, which remakes the energy system around it. The key feature of this world is the potential for new technologies to emerge from unexpected parts of the energy system. An indirect path toward renewable energy is followed, via advanced hydrocarbon technologies providing a bridge to a hydrogen economy in countries like China and India, and eventually creating a large pull for renewables or nuclear. On the surface, this world appears very chaotic because of the disruptive new technology. The early period is one of widespread experimentation, with the eventual winner hard to see. But underneath, a new infrastructure logic emerges, which only becomes clear after several decades.